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[For general information on the distribution of soil types in India see 6: Spate AW1 India, category 116, pp. 80-92.]

1; Drew G-3 (1862-1872) 1875 AV1 Kashmir AV1

5000; their outer base, where they rise from the plain, is about at the former level, and some points of the more inward ridges reach the latter; but the more usual altitudes are from 2500 to 3500 feet for the ridges, and from 1800 to 2400 feet for the intermediate longitudinal valleys.

In trying to give a detailed account of this area I shall first say a few words on the characteristics of the plain country that lies in front of the hills, and then, dividing the Outer Hill region into two parts, eastern and western, describe them in succession, taking first that which lies between the Rāvī and Chīnāb rivers, and next that which extends from the Chīnāb river to the Jhelam.

THE PLAIN IN FRONT OF THE HILLS.

Although in the Panjāb generally the humidity is greater the nearer one is to the mountains, yet the last of the plain, that part which adjoins the outermost hills, is a drier tract than what is farther away from them. I find two causes for this; one is that the soil is more porous, being of a lighter loam and liable to have beds of pebbles in it; the other is that ravines, which (originating in the hills) often cut across to depths of 100 feet or more, cause a complete natural deep drainage, and leave the surface somewhat arid.

In this respect there is a strong contrast with the corresponding tract under the Eastern Himalayas, where the hills are edged with the line of swampy ground called the Terai.

The level of this extreme part of the plains may be counted at from 1100 to 1200 feet above the sea. As one traverses it in a direction parallel to the run of the hills one crosses the numerous gullies or ravines (nullah or nālā is the much-used Indian word) which are of varying importance, according as they drain a smaller or a larger area. Many of these are dry in ordinary times, but show by their pebbly bed that water sometimes flows along them with force; these are they which rise on the outer slope of the first ridge. Then there are some which are never wholly dry; they usually have a small stream of water meandering over a wide low-level flat, cut down below the general level of the plain; these rise

1: Drew G-3 (1862-1872) 1875 AVI Kashmir AVI

rther back in the mountains, in the second or third ridge; they rain a larger area, and are subject to sudden falls of rain; such ater-courses will in certain seasons be filled for a time by a wide nd swift river, discoloured with red mud in suspension, carrying own in this way, as well as by dragging sand along the bottom, rge quantities of material from the hills to the lower grounds nd to the sea.

These ravines are from a few hundred yards to a mile wide; hey are bounded by a sudden bank, often cut into a river cliff of hundred feet in height that shows to view the sandy and loamy trata. Their flat bottom is mostly sandy; it is sometimes overed in part with the long tufty jungle-grass called in these arts *khar*.

The plateaus between these ravines, though, as before said, omewhat dry, have in great part been brought under cultivation; ere, as the crops depend entirely on the rain, their yield varies uch with the years.

The tracts where the jungle-grass abounds are frequented by the lack-buck or antelope, which indeed, encouraged by the game-aws of the country, spread into the cultivated parts and even herd ith the cattle. Near these grassy tracts the villages are com-osed of pretty thatch-roofed houses; in India straw is never fforded for the purpose of thatching, it is all used as food for the attle; indeed from the way the treading out the corn on the hreshing-floor is carried on no whole straw is left, so it is only here some such material as that stiff grass can be got from the ungles that any thatching is done.

The 70-mile strip of plain extending from the Rāvī to the Chināb is crossed by two large streams that deserve separate nention. These are the Ujh, that debouches by Jasrota, and the Tavi, that comes out of the hills by Jummoo. They are both ivers of perpetual flow and considerable, though much-varying, olume. They rise in the mountains at the back of the Outer Hills at an elevation of 13,000 or 14,000 feet, but not from hills f permanent snow; they have a course among the hills, the Ujh of some 50 and the Tavi of 80 miles, before they reach the

[i.e. in the plains of SOUTHERN JAMMU. -- ANALYST]

1: Drew G-3 (1862-1872) 1875 AVI Kashmir A VI

through the various ridges into the plain which it traverses until it joins its waters to the Chīnāb. 133 Y

As one approaches Bhimbar the plain country is more and more cut into by ravines; it may here be called a low table-land separated by them into sections; at the edges one sees how the soil is composed of layers of sandy loam with occasional pebbles. [134]

Opposite Bhimbar there appear on the south, in the British territory, the Khāriān Hills, a range a good deal like in structure and appearance to some of our outer hills, but quite out of the general direction of them, since it runs north-east and south-west; it may be said to belong less to the Himalayan system than to that of the Salt Range. Between these hills and our outermost range there still runs a narrow strip of plain, which for 12 miles west of Bhimbar is of that character just described, of ravines and low flat plateaus alternating. Beyond this, extending to the Jhelam, is a space of completely flat alluvial ground, little above the level of that river.

EASTERN DIVISION OF THE OUTER HILLS.

Recalling that this division is to include those which lie between the Rāvī and the Chīnāb, we will examine first the very outermost range. 133 X 137

The outermost hills of all belong to a ridge that, along the 70 miles between those two rivers, has the same characters. It rises from the plain with a regular and gentle slope of about 3°, that so continues till a height of some 2000 feet above the sea is reached; this slope is indented with many drainage valleys, not cut steep, but making undulations of the ground transverse to the run of the ridge. The surface of the hills is very stony; rounded pebbles cover nearly the whole of it, for the strata beneath are composed partly of pebble-beds. Still it bears vegetation; the hills are indeed clothed with forest; it is a close forest of trees 20 and 30 feet in height, mostly of two species of acacia and of *Zizyphus jujuba*,* with an underwood of the shrub called *Brenkar*,

* The native names of the acacias are *Phulāī* (*A. modesta*), and *Kīkar* (*A. Arabica*); the latter is called *Babūl* in Hindostan. The native name of the Zizyphus jujuba is *Ber*.

1. Drew G-3 (1862-1872) 1875 AV1 Kashmir AV1

the Jhelam, there exists more directly to the west of it a wide spread of lower hills which no doubt are geologically the equivalents of our first outermost range, which had lately, as we came west, become almost combined with the others, but now again has separated from them, and composes this broad tract, of which some detail must be given. From the plain by the left bank of the Jhelam, bare hills rise on the north somewhat quickly, to a not lofty ridge, of which the highest point is about 800 feet above the flat; the top of the rise is the steepest part; it is an escarpment facing south, composed of beds of clay, sand, and pebbles. From this main ridge, which runs east and west, there jut out to the south very narrow spurs, quite sharp ridges, separated by gullies; on the north of it the ground slopes with an incline at first of 4° or 5°, and afterwards with a much lower one, down to the town of Mīrpūr, the dip of the beds about coinciding with this slope. Near the top, all the soil is of pebbles; lower down, the sloping plateau is of sandy loam; this, too, is cut through by steep-sided ravines. Then, in one direction, this broken ground abuts against the more marked ridges of sandstone hills before mentioned, and in the other falls gradually to the valley of the Pūnch River.

The variation of this tract from the general run and character of the hills near is due to some bendings of the strata in a direction different from that of the main disturbances.

The Pūnch River just named is a tributary of the Jhelam; it drains a large area of mountain country, collecting a number of streams that rise in the lofty Panjāl Range; indeed it combines all those which spring from that part of the Range north or north-west of the branching off of the Ratan ridge. It drains also a considerable area occupied by the mountains of intermediate height, and no small space of the lower, outer, hills. Thus increasing in volume, it flows past the towns of Pūnch, Kotli, and Chaumuk, and falls into the Jhelam in that part of the country we were describing and now return to.

North of Chaumuk, there is first a partial repetition of the characters of the ground by Mīrpūr; there is comparatively low ground, and a line of pebble hills. Here the dip is south, Chaumuk

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roaring torrents for a few hours after heavy rainfall, but at other times are broad stretches of burning sand. This tract depends for a full crop on timely and well-distributed rainfall.

• [134]

The parched *kandi* hills are composed of a red loam, thickly strewn with round stones and covered with stunted growth of *garna sanatan* and *bahaikar* bushes, broad-leaved species of trees, acacias, and in parts bamboos. The *tor* (*Euphorbia*) is used to hedge the fields and cobble-paved paths, and to keep the *nilgai* from damaging the crops. The soil is thirsty and dries quickly, as the land slopes and drainage is rapid.

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Frequent rainfall is necessary to ripen the crops, chiefly wheat, barley, and *sarshaf* (rape) in the spring, and millet and maize (on manured land) in the autumn; but rain washes away the soft earth and leaves the surface of the soil a mass of stones.

Where the *kandi* hills end, and before the first limestone ridge is crossed, there is a narrow belt of cool land lying in the valleys traversed by the clear streams which carry the drainage of the middle hills on the lower side. When the depth of soil is sufficient, excellent crops are raised and much of the land is irrigated; but on the slopes where the depth of earth is small, and the limestone crops up to the surface (*prāt*), cultivation is precarious. Too much rain causes the soil to become water-logged, as percolation is stopped by the rock bed; and during a continued spell of hot weather the rock surface becomes so heated as to burn the roots of the crops, which wither.

Irrigation.

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In this portion of the province wells are few, owing to their cost. Except in the lowland bordering on the streams deep boring is necessary, and it is common to find that the water is from 70 to 100 feet below the surface. The cultivators are not as a rule sufficiently well-to-do to undertake the expenditure necessary to sink such wells, and risk the failure of finding water. Since the introduction of the regular settlement, the Darbār has done much to encourage the sinking of wells by the grant of advances on easy terms.

In this tract, however, are found the only considerable areas protected by irrigation. The natural difficulties to be overcome are great, as the lie of the land makes projects costly and difficult to execute. The lines of irrigation have to cross the drainage of the country, and it is not easy to secure the channels against damage from the *kadhs* when in flood. Owing to this difficulty, the more ambitious projects of former days—the Kashmīr canal taking off from the Rāvi above the

4 [For the province of Jammu — Analyst]

The Government have undertaken the execution of a scheme for improvement of livestock in the State on a systematic basis. A five-year scheme under which a large number of bulls of *Dhani* and *Sindhi* breeds are purchased and distributed among well-to-do *zamindars* in selected centres every year has also been sanctioned. Horse and mule breeding activities also have been started on a small scale, but a more comprehensive scheme is under consideration. Special interest has been taken in sheep-breeding, which is so important for the development of the wool industry in the State. Livestock shows are held at different places in the State every year, with a view to encouraging livestock improvement. More veterinary dispensaries are being opened every year. A laboratory has been established recently at Srinagar, where Goat Tissue vaccine is prepared for the treatment of animals.

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The Agriculture Department is doing useful work to improve agricultural conditions in the State. The activities of the Department which were at first confined to Kashmir Province only have been gradually extended to Jammu Province also. Agricultural and Horticultural experimental work and the demonstration of improved methods of cultivation of crops and fruit plants are important features of the Department's work. It also distributes improved seeds, grafted fruit plants, implements and manures, gives technical advice to orchardists and agriculturists and fights the San Jose Scale and other pests. Agricultural training is imparted to sons of *zamindars* at Government Farms. The Department has introduced high yielding varieties of wheat and corns including sugarcorns from the U. S. A., Canada and Russia, and several foreign vegetables and fruits.

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The soils of Kashmir Valley are very fertile and irrigation is easy in areas removed from water. The improved seeds distributed by the Agriculture Department have found favour with the *zamindars*. Hand labour in Kashmir Province has been found to compete favourably with agricultural machinery. In Jammu Province, the use of new iron ploughs has been demonstrated and the *zamindars* have purchased such implements for their farms.

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Sub-Himalayan Kashmir: Punch and Jammu

Very broadly speaking, Kashmir consists of two huge mountain masses —the Karakoram in the far N, the Himalaya/Zaskar to the S, with the Indus entrenched between them; and, on the S/s flanks of the main Himalaya, the famous Vale, walled in by the *Pir Panjal* which in turn breaks down into the lower but highly dissected Tertiary hills of the Punjab [illegible] the breakdown into seven units of study rather arbitrary, though not entirely so.

Kashmir includes a narrow strip, 5–15 miles wide, of the Punjab plains, here at 1100–1200 ft; this tract is badly ravined and of little significance except for the inclusion of the Mangla headworks of the Upper Jhelum Canal. N lies a belt of Siwalik terrain, hills up to 2000–4000 ft, largely anticlinal and overlooking a series of *duns*—longitudinal valleys—succeeded in turn by the Miocene Murree sandstones and Eocene Nummulitic limestone at 6000–8000 ft. The Siwalik zone, a "pile of rock waste" up to 20,000 ft thick, has undergone very recent folding and faulting, including early Pleistocene thrusting. In the earlier Tertiary zone strike-faults have disrupted anticlines and brought in massive Permo-Carboniferous limestones forming the higher ridges. The upper Murrees are preserved on the downthrow (S/s) side, while to the N the lower Murrees and the Nummulitics, resting with a great unconformity on the Permo-Carboniferous, are greatly disturbed and the terrain correspondingly confused; yet, "although dissection is intense, their heights display unmistakable signs of an older topography. Levelled spurs and plateau remnants, valley flats and abrupt terminations of high valley floors along master streams, indicate a mature relief which underwent rejuvenation".[1] This sub-Himalayan zone ends in the great boundary thrust-faults, beyond which rise *Pir Panjal* rises steeply.

Rainfall varies with aspect, but in general lies between 35 ins. in the W and 28 in the E, with a fair contribution in January–March; temperatures are of course affected by altitude and aspect. The low outer ridges carry a sparse dry scrub, the inner rather better forest, largely of *chir* or *chil* (*Pinus longifolia*); but felling for rafting into the Punjab has made serious inroads.

The Siwalik and Murree terrain, with thin thirsty soils, very liable to erosion and often degenerating into pebble-spreads, is agriculturally poor, as are the limestone slopes. Here and there, in *duns* and in a piedmont belt at the foot of limestone scarps, conditions are better. Irrigation is limited, as the water-table is generally deep for wells, and channels are liable to be overwhelmed by spates from the numerous transverse gullies; while some lower areas are so fever-ridden that cultivation is largely carried on by a

[1] de Terra (1939), 8, 18. Until further notice, citations to de Terra are from this very admirable work.

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cene known as *karewas*, which term is also applied to the Pleistocene sediments of which they are composed. These deposits consist of clays, sands, and silts of undoubted lacustrine origin, in which bands of marl and of loamic silt, together with lenticles of conglomerate from old deltaic fans, bear witness to many fluctuations of level. The sequence of events suggested by de Terra [1] is: (i) capture by the Jhelum of an original subsequent flowing to the SE, probably along the longitudinal course of the Chenab [2]; (ii) Pir Panjal uplift blocking this exit; (iii) filling of the lake and overspilling; (iv) alternate draining and deepening of the lake in response to glacial *changes and changes in the ratio of rainfall and snowfall at the uplift*; (v) continued uplift accompanied by cutting-down of the Jhelum and complete drainage of the lake. It should be noted that the various existing lakes, of which Wular is the largest (area 12 to 100 sq mile, according to season and flood) are not strictly relics of the ancient lake, but rather enlarged old oxbows and abandoned courses of the Jhelum; in some cases ponding by deltaic fans from the hills seems to be responsible.

In places the *karewas* have been eaten into great bluffs by the Jhelum, and the terrace lies at 450 ft above the river. On the S Karewas Beds extend from about 5400 up to 9000 ft, and are quite steeply tilted. With the Pir Panjal uplift the deposits were folded and in places faulted, another striking testimony to the persistence of orogenic process into recent, perhaps even contemporary, times. To summarize, we have [3]:

First interglacial	Lower Karewas deposition (c. 5000 ft), lake beds, fluvial inwash and eolian drift
Second glaciation	Karewas gravel (c. 4500 ft), glaciofluvial outwash fans
Second interglacial	Upper Karewas, c. 5000 ft—"topmost beds of eolian and fluvial origin; lower beds lacustrine; also fluvial outwash (partly waved)."

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The word *karewa* applies strictly to the level surface between the incised streams dissecting the terraces, the flanks of which are generally steep (Fig. 66). They are usually permeable and soils tend to be poor, though pressure of population enforces their cultivation. Lower down finer alluvium fills the marshy valley-floor, and where streams debouch from the hills fans of coarser material are formed. These relations are suggested by Fig. 65, which it should be noted does not represent any actual area, though all features shown are found on each of the several SOI 1/63,360 sheets.

[1] de Terra, 116–18. In this section, *karewa* = topographical, Karewas = geological.
[2] There is also connection via the depression of the Liddar and the submontane junction the Chenab at the Kishtwar bend.
[3] de Terra, tables at end; for general glacial sequence see above, 27–28.

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Vale of Kashmir

The climate is naturally continental, the severity of the winter being increased by drainage of cold air down the encircling slopes, and by radiation. Srinagar lies at 5200 ft and its climate is more extreme than that of hill stations lying 2000 ft higher on the outer Himalayan ridges:

Fig. 63.—Kashmir or the Vale of Kashmir. 1, mountain outliers (forest in S, grass or rock in N); 2, harmour; 3, marsh; 4, grass; 5, alluvial cone; 6, willows, poplars, orchards; 7, stream beds; 8, irrigation channels (beds); 9, dense cultivation; 10, springs. All blank areas cultivated except ravines and flanks of harmour (cf. Fig. 66). Altitude about 5200 ft along Jhelum, 5800 on upper margins of harmour, 6000–7000 on hills. This map does not represent any specific area.